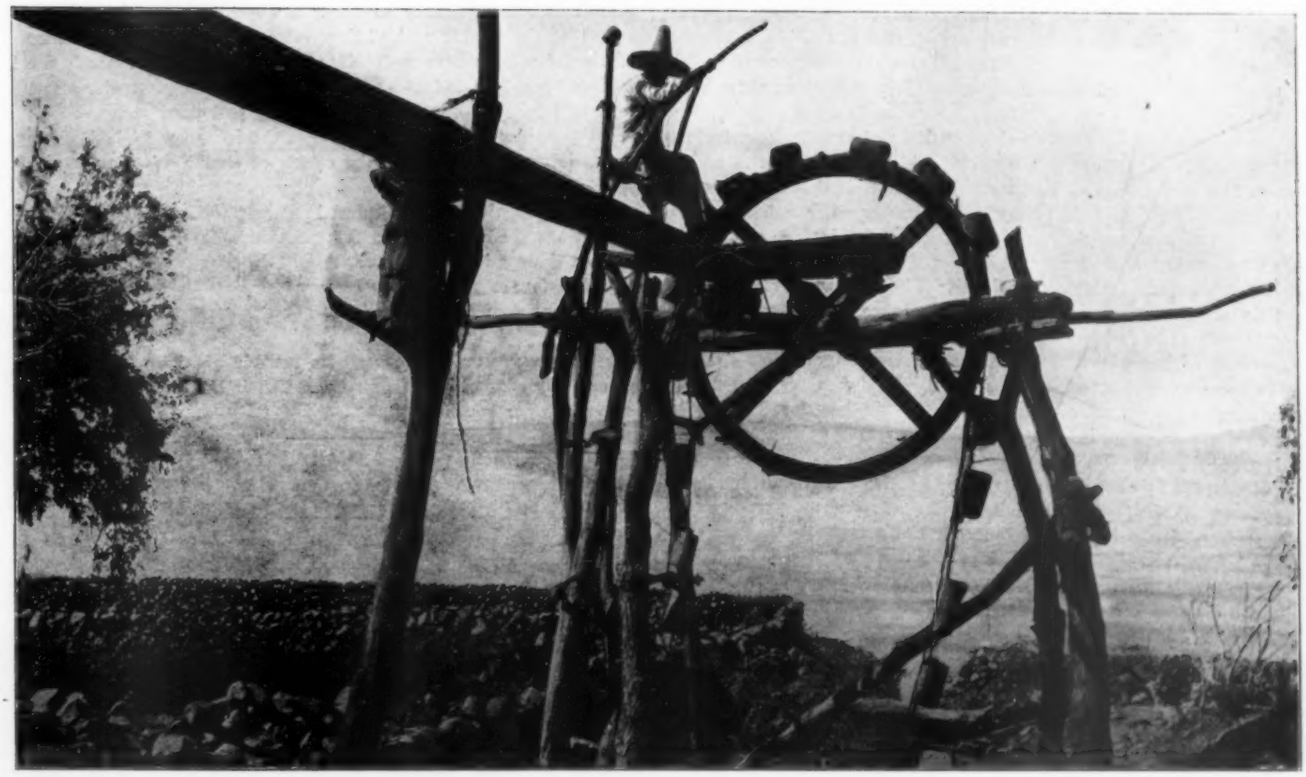
POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

TELLS YOU HOW TO DO THINGS. WRITTEN SO YOU CAN UNDERSTAND IT.

Vol 1, No. 16. CHICAGO, APRIL 26, 1902. PRICE 5 CENTS.

Queerest Water Works in the World



Courtesy of Modern Mexico.

Mexican Irrigation Wheel Recently Discovered

IN THIS ISSUE:

History of the Fire Alarm Telegraph.
How Excelsior is Made.
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Fishing with a Jug Line.
How Balloons Are Landed.
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Use of Cast Iron Boilers Increasing.
Electrical Development in 20 Years.
Giant Electric Machines.
Fire that Burned 50 Years.
Birds that Never Come to Ground.
Education to Prevent Train Wreck.
Window Glass that Will Not Break.
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ANCIENT MEXICAN IRRIGATION WHEEL DISCOVERED.

Strange Colony Who Live Apart from the Rest of the World and Till the Soil With Crude Implements.

A relic of the days when Mexico, unknown to the outer world, enjoyed a civilization of its own, when Mexicans ate from gold plates and gold glistened in the sands on the streets, is this remarkable irrigation machine shown on the title page. Hundreds of years ago with this device the ancient Mexican made fertile the barren soil. It made Mexico blossom like a garden of Eden and the desert lands to give forth their most luscious fruits in abundance.

The old irrigation wheels were thought to have become extinct when a short time ago a party of European tourists came upon a district in Southeastern Mexico where they were found in abundance on the shores of a crystal lake. Far isolated from any of the more progressive districts of Mexico, the region was inhabited by a colony of peaceful, frugal Mexicans, who, though living in primitive simplicity, were at least free from bondage, a boast that cannot be made by the poorer class of Mexicans of any other part of the country. As crude as is this "irrigation wheel," are the other implements employed by the colony. Plows and spades of forked sticks and hewn boards, knives of chipped rocks, houses of dirt and canopies of hides aided them in procuring a livelihood and in protecting them from the elements.

The "irrigation wheel" is made entirely of wood. Its principal mechanism is a large wooden wheel which turns a belt to which are attached a number of pails. The wheel is operated by man power. From its side protrude a number of wooden spikes which the Mexican presses down upon with his feet and hands with the motion of climbing a ladder. The pails attached to the belt are made of bamboo or hides. They are so arranged that they are in an upward position when ascending but gradually tip downward and sideways when they begin to climb over the summit of the wheel, thus emptying their water into a trough. This pours into another trough and on the water flows into a regular system of ditches, often miles in length The water may be either emptied into a distant reservoir or flowed directly over the soil. The wheel and troughs are supported on rough poles, made by cutting down trees and sticking them firmly in the ground. This is probably the oldest as well as the queerest system of irrigation in existence at the present time.

TO BUILD A MORMON TEMPLE IN DENMARK.

Money is being collected in the United States for the erection of a Mormon temple in Copenhagen. It is proposed that the edifice shall be similar to the parent tabernacle in Sale Lake City, to which about 500 Mormon converts come annually. There is local opposition to the temple and the propaganda, but the work goes on, secretly or openly, without abatement. The sight of the structure has long since been bought and paid for, though the hostile Danish press says it will never be allowed to be built.

Numerous Danes have become Mormons of recent years, it is claimed, and Denmark is regarded as a most promising field for mission work in behalf of the sect. A Mormon newspaper and publishing house for the dissemination of tracts and books have been established in Copenhagen.

America produces more copper than any other nation in the world. The metal is now on the free list and as a result of the low price 63,840,000 pounds were shipped out of the United States during the first two months of this year. Last year copper to the value of $31,600,000 was exported. The manifold new uses for electricity will greatly increase these figures in the future.

Fishing has been carried on at Gloucester, Mass., since the year 1623, or almost 300 years.

CAST IRON BOILERS GROWING IN POPULARITY.

Many Advantages Over the Wrought Iron for Low Pressure Steam and Hot Water Heating.

America and Germany lead in the manufacture of cast iron boilers which, for low pressure steam and hot water heating, are continually growing in popularity. Their efficiency is said to be much greater than wrought iron because of the better arrangement of the flues and contact fire surfaces. The ratings vary from 5,800 to 8,000 British thermal units of heat per square foot.

Director Schiele of Hamburg in the Metal Worker of Jan. 18 relates the following advantages of the cast iron boiler over the wrought iron:

The ability to make the boiler in sections and send it either as a whole or in parts; it requires much less room than other boilers; needs no brick setting and has a higher efficiency because of the better arrangement of the fire surfaces with consequent better utilization of products of combustion; the desired forms or shapes for the building of the fire chamber, fire surfaces and some flues are readily obtainable; the lower selling price and the possibility of using a water grate, which can be a part of the section and adding to its fire surface; the absence of rivet heads, offsets and joints and the resultant smooth fire surface; cast iron is less sensitive to the process of rusting; cast iron will take on one coat of rust only and does not peel off; and the ability of cast iron to resist the influence of bad water on its interior surfaces and the effects of smoke gases on its fire surfaces.

The principal objection offered against the use of cast iron boilers are their liability to fracture from extreme pressure or sudden change in tempeature. A cast iron boiler has very little capacity for storing heat. It is possible to have 1½ pounds pressure on a steam system in 20 minutes after starting the fire, while, on the other hand, it is well known that they rapidly lose pressure, necessitating the use of a reliable regulator. The pressure to which the manufacturers test their boilers is from 30 to 90 pounds per square inch.

WHEN THE EARTH'S GREAT HEAT RESERVOIR IS TAPPED.

We have told in previous issues of efforts made to utilize the heat from the earth's center as a source of power. When once the sulphur dioxide engine, the thermo-electric couple or some other means may be devised to tap this great heat reservoir, with its inexhaustible supply of heat, beside which the coal deposits of the earth, consumed and unconsumed, pale into insignificance, it will mean a new civilization, a new world, the greatest step in advancement, a hundredfold, that the earth has ever known. There will be no longer need of coal and the fuel problem would be solved for all time. Manufacturing enterprises would drill into the ground, not for water supply for their power plant as now, but for the power plant itself. Any one with enough land on which to build his factory would be able to use his basement as a power plant by extending it downward indefinitely. Owners of apartment buildings would have no more trouble with steam heat, and the janitor who toils away during the day throwing coal into the maw of the steam heater would only have to turn a lever and let the heat on or off as desired. As there will be no waste of power when it is shut off, and no expense for turning it on once the engine is in place, the tenants can have warm rooms when the northeast winds blow in June. It would fill a volume to mention all the things that suggest themselves as happy possibilities for the time when the earth itself shall give man his light, heat and power direct. And Prof. Mendenhall gives hope that the time is not far off.

The United States has 189,295 miles of railroads, which is more than is possessed by all the nations of Europe combined.

THE FIRE ALARM TELEGRAPH

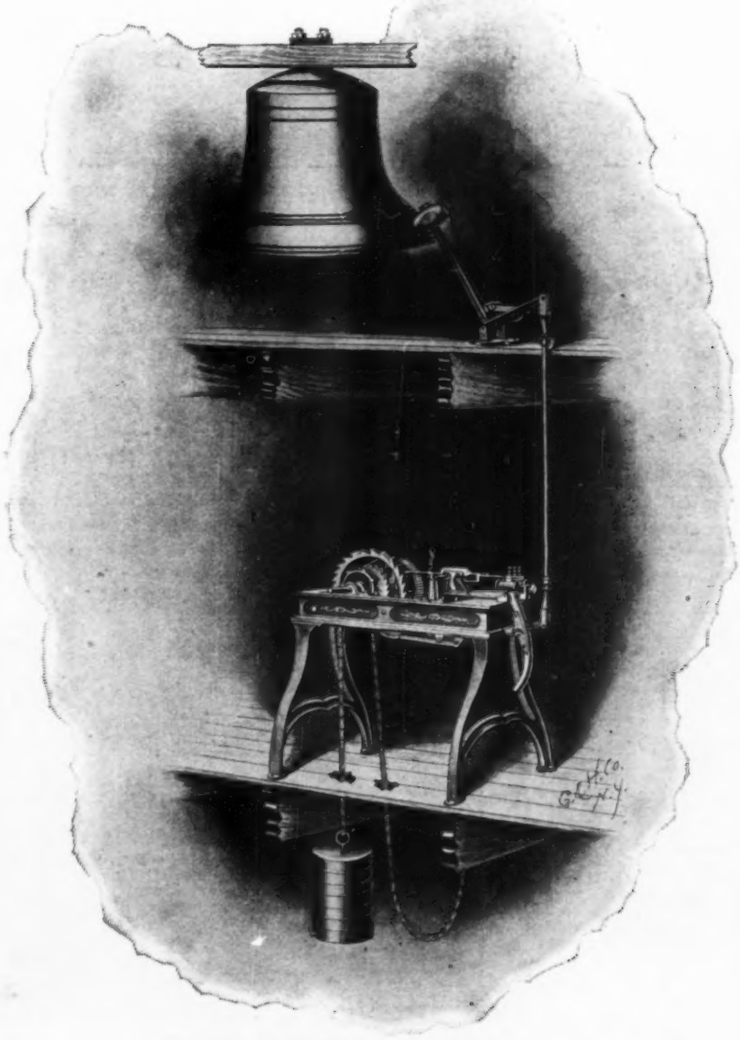
April 29 Marks 50 Years of Service

At 8:15 in the evening of Thursday, April 29th, 1852, a small iron box might have been seen fastened to a church at the corner of Cooper and Endicott streets. A man, breathless with running, reached the box threw open the door, seized a little crank within, turned it several times, and every fire bell in Boston, obedient to his action rang out the first alarm to be signalled with the Fire Alarm Telegraph. The echoes of these bells are heard today in every city and almost every town in the land.

Boston celebrates the 50th anniversary of the above event on Tuesday next, and a brief history of the system which has saved untold millions of money and thousands of lives will be found interesting at this time.

FIRST FIRE ALARM BOX, BOSTON.

ELECTRO-MECHANICAL WHISTLING MACHINE.

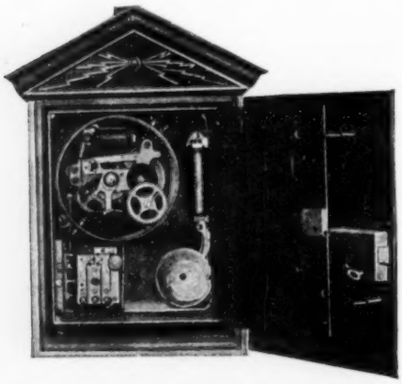


ELECTRO MECHANICAL BELL STRIKER.

Dr. W. F. Channing of Boston was the one who in 1839 suggested an application of Prof. Morse's telegraph experiments to a fire alarm. In 1845 he published his plans and in 1851 Moses C. Farmer, the most expert electrical mechanic of that day, joined him in working out and constructing a system for Boston which cost $15,000. In 1859 John N. Gamewell purchased the patents of Channing and Farmer, and devoted 35 years to the perfection of the system which is universaliy known by his name. Gamewell died in 1896 at the age of 74 years. The system made slow progress at first; New York adopted it in 1869, at which time 20 cities had fire alarm telegraphs.

The first signal boxes required several turns of a crank or pulls on a lever, but the box of today responds to a single pull on the hook or thumb piece. This sets in motion a set of clockwork which cannot be stopped until it has sent in the number of its box to the central office to which the box is connected by wires. The in-

stant a street box is pulled the apparatus in the central office responds by sounding the number on a tapping gong; the same number is recorded by the multiple pen-register, and a set of cylinders revolve, each one displaying a figure which taken together correspond to the box sending the alarm, and setting the machine for action. The operator now moves a lever and instantly the box number is being tapped in all the engine houses on a small gong and recorded on a tape. The operator then goes to the manual dial transmitter and by a few turns of the dial sets the



box number and throwing a lever, in every engine house is sounded on the big gong the box number, while the indicator above the gong displays the number. All alarms are therefore received simultaneously at the engine houses over two distinct circuits, and are registered and announced on two sets of instruments.

All of this is done within less time than it takes to read this description of the process, and usually before the alarm box stops running, after it has been pulled for an alarm of fire, the alarm has been received at the central office, has been sent out over two independent circuits to the engine houses, the firemen have responded to the call, the horses have been harnessed, and the engines are away upon their work of saving life and property from destruction. In the whole range of electro-mechanical appliances nothing equals this wonderful display of the movement of a small army of trained men, with horses and machines, from many remote and isolated points, springing into simultaneous and powerful action within three seconds after the pulling of a little lever in a street box, miles away, it may be, from fire headquarters.

So wonderfully perfect is the system that when two boxes are pulled at the same instant there is no confusion; one waits to make its report until the first has finished speaking. In the central office an electrical annunciator board shows just what companies are out of their stations.

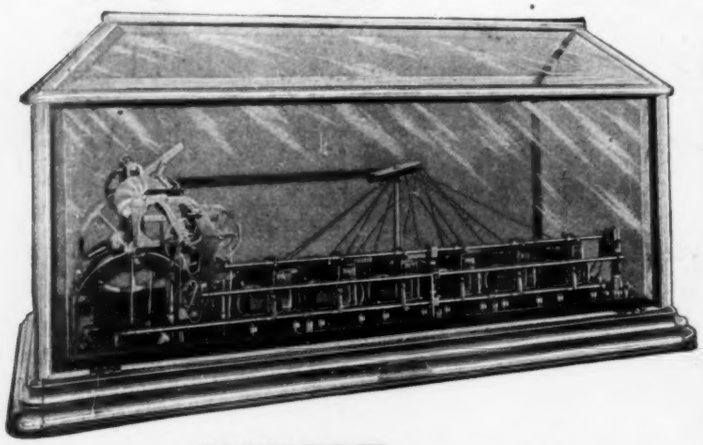
In a fully equipped central office an automatic line tester automatically tests all the circuits of the entire system and once in 20 minutes reports any grounds or openings in any circuit. Another ingenius machine is the multiple pen-register, a mechanical bookkeeper; which writes down on a broad roll of paper a record of every signal which comes in or is sent out.

To return to the street boxes; there are several types of these. Some are keyless, some hold keys in a glass box to be broken open when needed; others are opened by keys in the hands of police or citizens. These keys are numbered, and a record kept to whom issued. The key cannot be withdrawn until an officer comes with a release key. Some boxes do not even use the hook but send in their alarm by the mere opening of the door. Some have alarm bells which sound loudly when the door is touched. The alarm is to guard against the malicious use of the box.

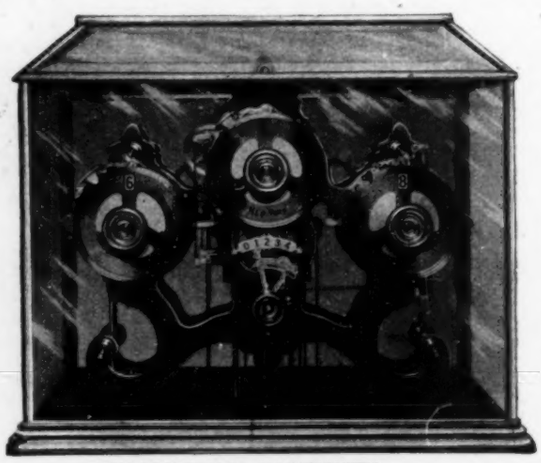
Among the many interesting accessories must be mentioned the electro-mechanical

EXCELSIOR GONG AND INDICATOR.

whistle which is often used where boilers can be found which are always under a good steam pressure. These whistles sound their far reaching signals with distinct blasts. Then there are the electro-mechanical bell strikers which can be attached to any bell without interfering with its use for school, church or other purposes. To enter into a minute description of all the mechanism and the diversified functions of the various apparatus which is included in a complete system would require many pages, and so with the above general description we will leave the machinery to

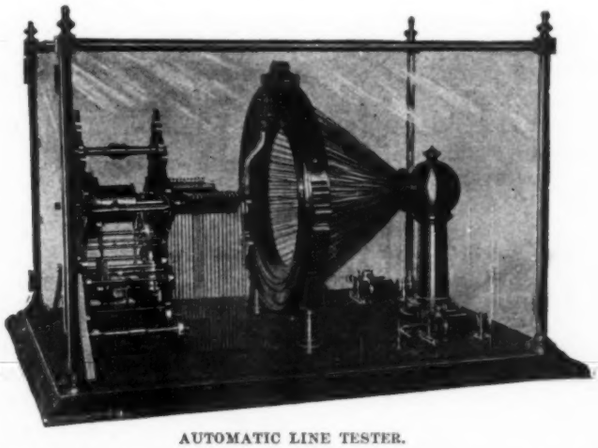


AUTOMATIC REPEATER.



MANUAL DIAL TRANSMITTER.

the electricians who care for it. We desire in closing to acknowledge courtesies extended by President Joseph W. Stover, who has largely contributed to the development of the Gamewell system, of which company he has been president during the past 20 years, and to Mr. Frank C. Stover, the company's Chicago manager.

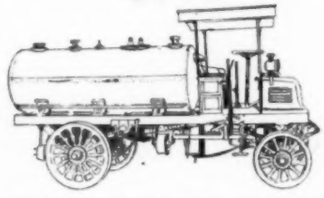


AUTOMATIC LINE TESTER.

AUTOMOBILE FOR CARRYING ACIDS.

Made for a Dealer in Chemicals—Weighs 24,000 Pounds.

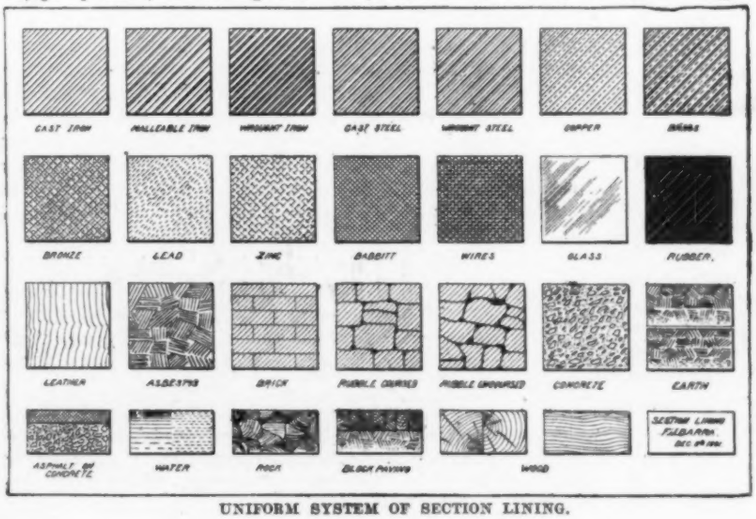
An automobile for the delivery of acids, manufactured for a German dealer in chemicals, is one of the oddest looking devices in the horseless wagon line that has ever appeared. It is called the Kuhlstein-Vollmer tank wagon. The total weight is 24,000, and it can attain a speed of 8½ miles an hour. It can carry a load of 12,850 pounds, including the tank, which weighs 2,600 pounds. A 17-horsepower motor is used, the normal speed of which is 650 revolutions a minute. A vertical two cylinder motor and electrical device, says the Motor Age, is in front of the machine. Power is transmitted by means of a level and spur gear device mounted on the crank shaft. The differential is carried on a counter shaft, the drive to the wheels being accomplished by chains, one on either side. The fuel is kerosene, the cost of which is .792 pound per horsepower, at a cost of one-half cent per mile.



UNIFORM SYSTEM OF SECTION LINING

A movement to systematize section lining in mechanical drawings has been started by some of the leading draftsmen and technical journals. The accompanying illustration shows the markings used to designate materials as proposed for a standard system. These linings are now employed by the Central Institute and by most of the leading craftsmen.

At present wood is about the only material on which all draftsmen agree with regard to its lining. Glass, says The Draftsman, is frequently shown with vertical lines instead of on an angle and nearly always in the upper left hand corner of the window or door drawing. Asbestos could be represented by wavy lines instead of straight, and can be applied to cloth, gum canvas or any composition material, such as pipe coverings, paper mache, etc. No lining should be as heavy as the outline of the object and yet each line should be clear and evenly drawn, and some of the finer work can be put in with a pen.



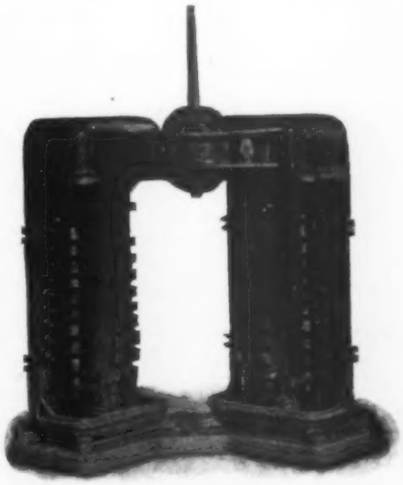
UNIFORM SYSTEM OF SECTION LINING.

ENGLISH DESK TELEPHONE.

The illustration shows the type of desk telephone generally used in England. Like the wall telephone, the receiver and transmitter are attached to a handle which brings the ear piece to the ear and the mouth piece in speaking position. A call is made by punching the button shown, instead as with us by the act of lifting the receiver.

ELECTRICAL CONTROLLER FOR CRANE.

Electricity is being generally used both here and abroad in operating the large harbor cranes for loading great weights into vessels. Often these pieces of freight weigh 20 tons or more each. The great crane which does the hoisting is operated by one man by the simple movement of a small lever, the massive crane with its load moving up or down in the same direction the lever is moved.



Easy Electrical Experiments FOR BOYS

By L. P. Dickinson

CHAP. XVI.—HOW TO MAKE A 1-20 H. P. MOTOR.

THE FIELD MAGNET.

In the preceding chapters directions have been given for constructing the armature, or the rotating part of the motor. Besides this, there must be constructed the field magnet, which surrounds the armature, and furnishes the magnetic field which causes the armature to rotate.

The field magnet frame must be of iron, and this is where the main difficulty comes in. The best form of frame could be made by having it cast to the proper shape. But not every boy is situated so as to have access to a foundry, and besides, the difficulty of constructing patterns properly would make it inadvisable to attempt this method of construction. The form described in this chapter has been designed with the idea that everybody has access to a blacksmith shop, and can readily induce the man at the anvil to do the necessary work, which is very simple.

The form of the field magnets is clearly shown in Fig. 1, where A represents pieces of iron, bent into the shape shown, and bolted together at the top, with a piece of iron, B, clamped between them. The strips A are made of a piece of iron bar ¼ inch thick, 1¼ inches wide and about 8 inches long. As shown

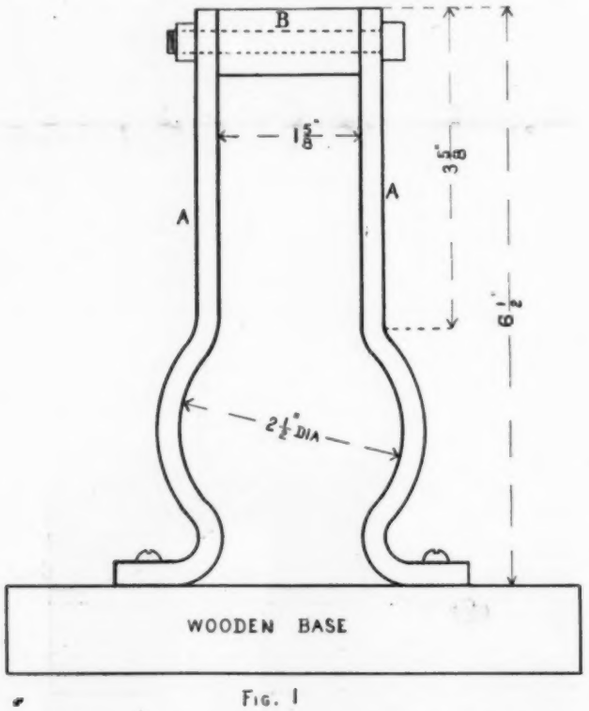


Fig. 1

in Fig. 2 there are four of these strips bolted to a piece of iron at the top.

It may be well to state that the reader may exercise considerable ingenuity in the choice of arrangement of his material. That is, if it should happen that no iron stock is available whose dimensions are the same as those given, then the amateur can modify the dimensions given to conform to his particular case. Be very sure, however, that the diameter of the circular chamber at the bottom of the magnet is exactly 2½ inches. Too much care cannot be exercised in making the iron conform to the right shape and dimensions at this point. For this reason it is well to cut a circular disc from a piece of thin sheet iron, of a diameter of 2½ inches. By holding this against the curved portion, on the inside face of the iron, any irregularity in the shape of the iron can be quickly detected.

The iron block shown at B is 1⅝ inches wide, 1 inch thick and 2½ inches long. Here again the amateur may, if necessary, use

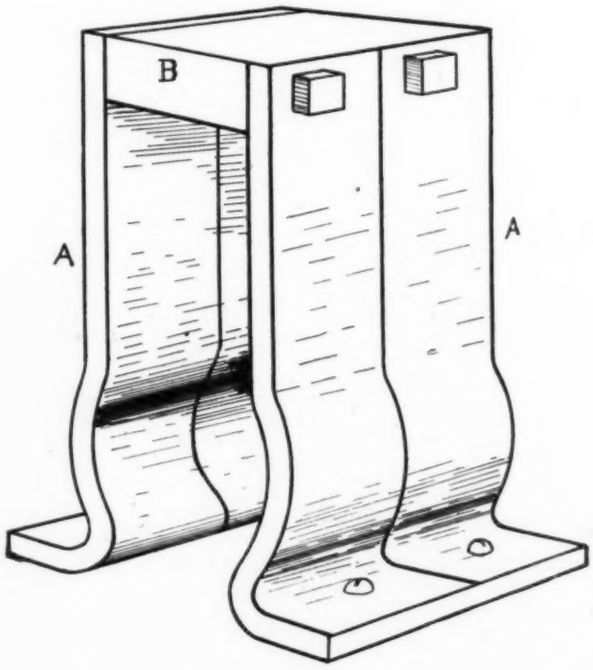


Fig 2.

two blocks of iron instead of one, if a piece of iron of the right shape be not available, but the dimensions and construction given are thought to be the simplest and best.

Having caused four pieces of iron of the shape and dimensions shown at A to be constructed, have a machinist bore a ⅜-inch hole through each at the top, the hole being in the center and at a distance of ½ inch from the end of the bar. Having procured a block of iron such as is shown at B, and of the size, just given, have two ⅜-inch holes bored through it from one of the 1-inch faces to the other. These holes should be so placed that the strips when bolted to the iron block will lie closely together, with their outer edges even with the ends of the block. Procure two bolts (preferably with square heads) ⅜ inch in diameter and 2½ inches long. These are for the purpose of clamping the pieces to the block. Before this is done, however, have a ¼-inch hole drilled through the projecting foot at the bottom of each iron strip so as to able to screw the pieces firmly to a board.

With a file smooth off the faces of the block B, and the inside faces of the strips A, so that they will fit smoothly together. Then bolt them together tightly. Then test the circular chamber at the bottom to see if it is of the right diameter and form. If there are any irregularities in it smooth them off with a coarse file. If the faces of the iron block at the top are not square, it may be found that the iron strips are not in line. File the blocks until it is of the right shape to make the strips lie parallel and in line.

Procure a piece of board for a base, 1 inch thick, 12 inches long and 6 inches wide. Mount the field magnet frome upon this board in its center, by means of heavy screws passing through the holes in the projecting feet at the bottom. Be sure that the magnet frame is parallel with the edges of the board and in its center.

[Note.—Several requests have been received from readers asking for a printed scale to use in connection with Chapter 9. Such a scale will be found on another page, where it may be cut out and used.—Editor.]

POWER OF AN INDUCTION COIL.

Inquiry has been made regarding the power of the induction coil described in Chapter IX. There is no way of calculating directly the length of spark that such a coil will give, for this depends upon so many uncertain factors. These factors are (1) the quality and length of the soft iron wires composing the core; (2) the number of turns of wire in the primary; (3) the number of turns in the secondary; (4) the sharpness of the break in the primary circuit by means of the vibrating armature. The second and third factors are easily determined, but the first and fourth are very uncertain and variable. The best that can be done is to compare the coil with others of similar dimensions. As constructed, the coil will not give more than a ⅛-inch spark, although the current obtained will be as powerful as anyone can endure. If fitted with a condenser (which will be described in a later paper) the length of spark may be increased.

NO REASON FOR ADVANCE IN IRON AND STEEL PRICES.

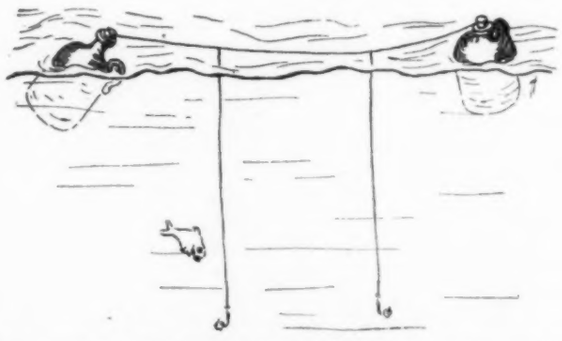
There will be an abundance of iron and steel to supply the very great demand of the next year, according to estimates, and no excuse for an advance in prices, which is threatened. The Railway Review says:

"The entire steel trade is threatened with a general advance in prices because of the phenomenal requirements that are being presented from all parts of the compass. Further on the Review states:

"It looks from the common sense standpoint as though the anticipation of iron and steel requirements would be over done. Projections of new steel works are heard of almost every week. The sounding and boring for ore lands is going on constantly and large ore areas have been recently added to known fields. The entire situation is full of interest and whatever comes or goes we may rest assured that in 1903 there will be a sufficient, and, in fact, an abundant supply of iron and steel material for all purposes."

FISHING WITH A JUG LINE.

An interesting method of catching fish is in vogue on the lower Mississippi river. The operator secures as many empty gallon jugs as he can and corks them tightly. Then he fastens the jugs to a strong line at intervals of about 30 feet. To the jug line are attached numerous short fish lines about 10 feet long at the end of which are the usual lead sinkers and baited hooks. This done the outfit is put in the water and taking one end of the jug line he rows out into the middle of the stream. The jugs float down stream taking the baited lines along, and



thus several hundred feet of river are fished at one time. When a jug goes down the boatman rows to the place and pulls in the fish. The river fisherman frequently floats several miles in this manner, or until he has caught a good boat load.

In place of the white tents used up to this time in the United States army, khaki-dyed ones will henceforth be purchased.

LIFE NET, BORN OF THE SKYSCRAPER.

Leaping from Great Height a Person Experiences but Little More of a Jolt Than in the Rocking of a Cradle.

Not long ago persons in leaping from burning buildings risked being dashed to death on the pavement below. Now they may jump from almost any height and not even receive a jar. This is made possible by the Browder life saving net, considered by firemen as one of the greatest inventions of the age. This net is a natural outcome of the modern skyscraper. Thoughts of the horrible fate of those entrapped in the top floors of these towering structures while fires raged below put the humane inventor's mind to work and this, the latest

MAKING A TEST JUMP.

and most perfect life saving net, is the result. Introduced in New York just one year ago, it has already been the means of saving scores of lives and those who have known its splendid service think its use should be made compulsory in all fire departments.

The Browder life saving net is manufactured by T. F. Browder & Co., Greenfield, O. When open and ready for use the net makes a circle 9 feet in diameter. Around the circle are thirty hangers, equal distance apart. Each hanger passes through an eye, and a coil spring about 14 inches long. The eyes through which the hangers pass are connected by a leather strap to the heavy canvas, which forms the main body of the net. Inside the canvas is a pad, composed of cotton batting, nicely quilted, having a red center as a target at which the rescued is to aim in making the leap. This pad is connected to the canvas by thirty gum stretchers. When the jumping person strikes the net, instantly the thirty hangers and coil strings move upward and inward to the center, thus transferring the shock to the solid circle, and in case all the tension of the springs should be taken up the shock is received by the circle and the men holding the net receive no shock whatever. The rebound is also counteracted and the person striking the blanket does not bound off it, or receive even a shock. The net works automatically. It folds up in halves or quarters, and can be dropped open and made ready for work in an instant.

The official souvenir buttons of King Edward's coronation now being distributed in London are of American manufacture which fact is printed on every button. Thousands of them have been ordered of an American manufacturer by a London firm.

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ENGLAND'S QUEEN AN AUTOMOBILIST.

Queen Alexandra is becoming an accomplished automobilist. She now possesses a really beautiful Victorette, which is very light and in appearance a most comfortable carriage. Her majesty now drives herself all around Sandringham. She is generally accompanied by the Princess Victoria and her private secretary, the Honorable Miss Knollys.

FIND NEW MAMMOTH CAVE.

Some quarrymen engaged in blasting rock in the canyon of the Jefferson River, about fifty miles east of Butte, Montana, made an opening into a large cave.

Several days were spent in the cave and explorations made covering an extent of ten miles or more to a depth of nearly one thousand feet. A large river with a cataract of about one hundred feet was explored for a distance of several miles without discovering its source or outlet.

A few articles of stone and copper utensils and some bones, believed to be human, were also discovered in one of the large apartments explored. There were other evidences that at some time in a prehistoric period the cave was used as a habitation. The belief of a scientist with the party of explorers is that an earthquake closed the entrance to the cave and killed its inhabitants.

WONDERS OF GOAT LYMPH CURE.

Physicians from all parts of the United States and Europe are arranging for a conference in Chicago to determine the limits of the new goat lymph treatment. Reports of seemingly miraculous cures of obstinate diseases by the use of goat lymph have attracted the attention of the profession and a move is to be made for the general adoption of the treatment, which has progressed beyond the experimental stage. One eminent Chicago physician, in speaking of the project, said: "There is no longer any doubt but what goat lymph when properly administered will effect cures in locomotor ataxia, paralysis, primary dementia, chronic articular rheumatism and some forms of tuberculosis. One of the strangest features of the treatment is that it not only conquers disease, but it restores the functions of youth to aged people."

There is mourning among newspapers and in diplomatic circles because the president's son's dog Jack is ill with pneumonia.

Marconi declares that electric flashes from trolley cars interferes with his wireless telegraphy, and the officials of Sydney will allow no electric car within one-third of a mile of the new Cape Breton wireless telegraph station.

Merchandise shipped from the United States to the Philippines for nine months ending last September amounted to $2,782,190, an increase of $1,140,218 over the same period for 1900.

Chief C. H. Downing of the fire department of Lynn, Mass., is America's oldest fire chief. He is 74 years old and has more than sixty years of active service to his credit.

The Norwegian government is to make experiments with oil as feul for boilers at the government navy yards at Carljohansvaern, Horten.

Senator Gallinger of New Hampshire sent to the library of Congress the other day for a Bible. One of the oldest employes in the library says that in forty-two years this is the second time such a request has been made by a member of either branch of Congress.

Japan will establish at its experiment station a model factory, or technical school, for training workers in window glass manufacture. All the window glass now used there is imported and amounts to about $700,000 a year. Foreigners will be employed to teach the art. An American applicant for employment as an expert glass maker should apply through the Japanese legation at Washington.

The government of Canada has concluded an agreement with Marconi for the establishment of the Marconi wireless telegraph system between Canada and Great Britain.

HOW BALLOONS AND AIRSHIPS ARE LANDED.

For effecting a landing a balloon is equipped with a drag-cable, an anchor with a suitable cable and an arrangement which enables the aeronaut to quickly release the gas contained in his balloon in case the hold of the anchor should prove insufficient to hold the strain. The valve of the balloon serves to let part of the gas escape so as to descend gradually.

Scanning the country carefully in the direction toward which the balloon is drifting, the aeronaut chooses a suitable place for the landing. The valve is opened and the balloon begins to sink. When it has reached a distance of about fifty yards from the surface the drag cable is dropped. The progress of the balloon becomes a great deal slower, owing to the friction of the cable and the aeronaut can now decide where he wishes to land. A convenient creek or ditch, with high banks, offers a suitable hold for the anchor, and the latter is allowed to slide down. For a short distance it is dragged over the ground, but finally it takes a firm hold and the wind lays the balloon on its side, the basket resting upon the ground. Then the moment has arrived for pulling the "ripping cord," a device for ripping the covering. One strong pull and with a sigh the gas escapes from the balloon. The voyage has reached its end.

Artificial eyes were formerly painted on porcelain, which was glued on flesh colored cloth. This in turn was fastened onto the face directly over the defective eye. Glass eyes were first used in 1579.

LOCOMOTIVES OF A CENTURY

[Being an illustrated history of locomotive invention, building and progress. The facts are taken from a paper by S. M. Vauclain, read before the New England Railroad Club. The illustrations were gathered and engraved by the Baldwin Locomotive Works, by whose permission they are used.—Editor P. M.]

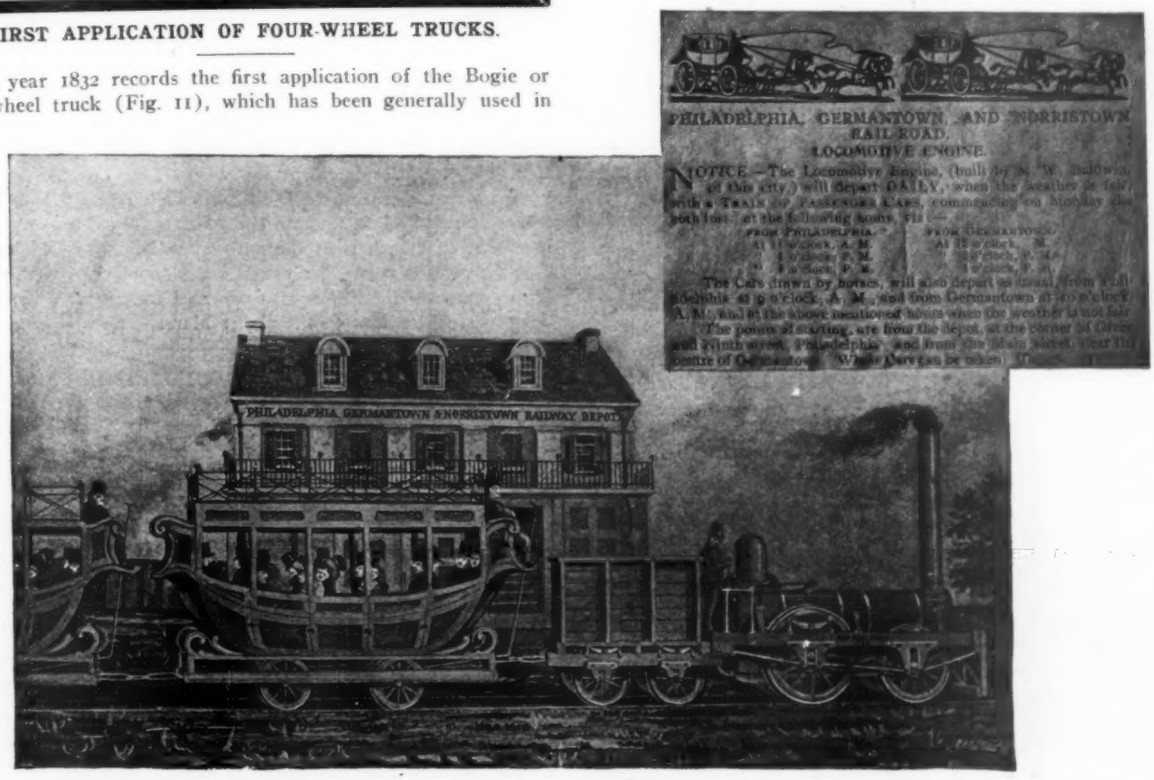
FIRST APPLICATION OF FOUR-WHEEL TRUCKS.

The year 1832 records the first application of the Bogie or four-wheel truck (Fig. 11), which has been generally used in America since. It has been universally adopted in all recent English designs.

The "Crabs" of 1832-34 (Fig. 12), the famed old engines of the Baltimore & Ohio, have just recently been cut up for scrap iron after having been in service on that road for two-thirds of a century.

In 1836 the ordinary eight-wheel engine, since known as the American type, designed by H. R. Campbell, was built by the Baldwin Locomotive works. It is shown in Fig. 13. This type perpetuated even until today has been one of the very greatest factors in America's wonderful development. Specimens may yet be seen in the most magnificent engines of the present time.

The Campbell engine immediately suggested the equalizing beams which were employed on the engine "Hercules" (Fig. 14),


PHILADELPHIA, GERMANTOWN, AND NORRISTOWN RAIL ROAD.
LOCOMOTIVE ENGINE.
PHILADELPHIA GERMANTOWN & NORRISTOWN RAILWAY DEPOT.

LOCOMOTIVE "OLD IRONSIDES" ON THE GERMANTOWN AND NORRISTOWN RY., WITH FAC SIMILE OF ADVERTISEMENT AND TIME TABLE, WHICH APPEARED IN "POULSON'S AMERICAN DAILY ADVERTISER," NOV. 26, 1832.

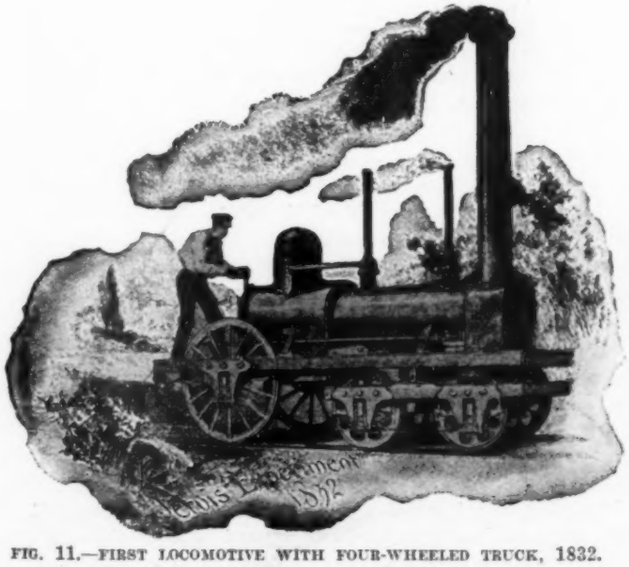


FIG. 11.—FIRST LOCOMOTIVE WITH FOUR-WHEELED TRUCK, 1832.

FIG. 12.—ROSS WINANS' "CRAB," 1832-34.

built in 1837 by Eastwick & Harrison, a Philadelphia firm of locomotive builders. Bolted stubs were also employed on this engine instead of the gib and key.

The year 1837 also records the first product of the once famous

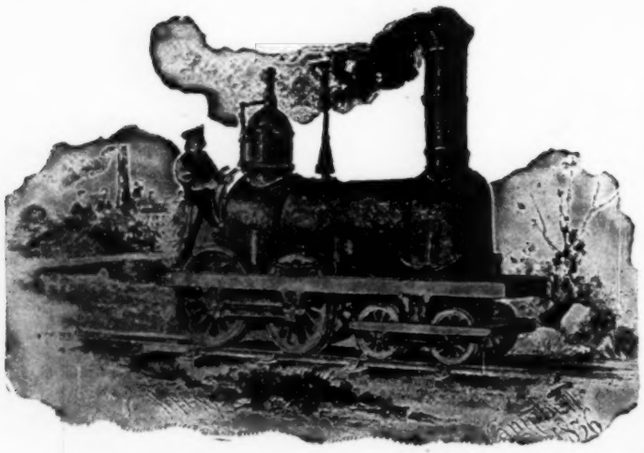


FIG. 13.—H. R. CAMPBELL'S EIGHT-WHEEL LOCOMOTIVE, 1836.

Rogers Locomotive Works, the recent close of which is a source of general regret. The first Rogers engine is shown in Fig. 15.

FIG. 14.—EASTWICK & HARRISON'S LOCOMOTIVE, 1837.

FIG. 15.—ROGER'S LOCOMOTIVE, 1837.

It is remarkable in being the first locomotive to be sent west of the Ohio river and it was the first locomotive to have four fixed eccentrics and counterbalance weights in driving wheels.

(To be continued.)

ELECTRICAL DEVELOPMENT IN TWENTY YEARS.

The advance in electrical work in twenty years has been remarkable. The Electrical Review sums up the history briefly in a review in which the following is extracted:

In 1882 the arc light was used to a limited extent for street lighting, but the incandescent lamp was still a novelty. The telephone was confined to the larger cities. The trolley car was practically undreamed of, and an electric motor was a curiosity.

Today $500,000,000 are invested in telegraphs in this country alone. Five million calls a day are made on our telephones, while the copper wires would reach to the moon and back six times. The power used to make electric light for New York City exceeds the combined engine power of the entire navy of the United States. As much money has been spent in building trolley roads as the cost of the Civil War, while half a million horsepower is required to operate these lines. More passengers are carried each month than the entire population of China, while during a year the number exceeds the population of the earth. If the power of the trolley roads was all concentrated in one arc light it could be seen on the planet Mars.

NO IRON OR STEEL SHIP EVER BUILT IN CANADA.

Notwithstanding the abundance of iron ore Canada possesses, a steel ship has never yet been built out and out in that country. All the vessels built there are of imported material. The Canadian Manufacturer says:

"No iron or steel ship has ever yet been built in Canada, the plates, angles, beams, etc., of which were made in Canada. We have never yet had the facilities to convert the original raw material into completed ships."

AUSTRALIA LIKES IT, TOO.

Robert A. Pearson, an extensive operator of roller flour mills at Armidale, New South Wales, Australia, writes, "I have just seen a copy of "Popular Mechanics" and am very much pleased with it. Enclosed find money order to pay for a year's subscription. If possible commence with No. 1, and send me the back numbers."

Isaac Getting of McKeesport, Pa., recovered his speech, after having been dumb 18 months, and then talked himself to death. The nurses and attendants found it impossible to keep him from talking.

The United States imports about 10,000 tons of toys a year from Germany, consisting principally of dolls.

More than 100 cases of art exhibits have been shipped from New York in the past month for the First International Exposition of Modern Decorative Arts at Turin.

Dark Cloud, an Indian model, is making a fortune in New York posing for illustrators and sculptors. He is considered the best all round study model of his race.

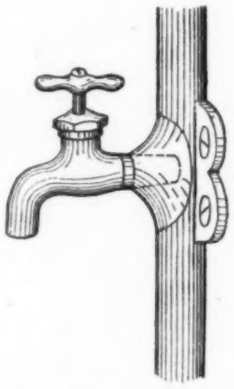
The Countess Castallane has started a movement to erect a monument to President McKinley in Paris.

Miss Eva Arnold, of Alto Pass, a trifle more than four feet tall, and weighing less than 100 pounds, is the smallest school teacher in Illinois, yet she has among her pupils some of the largest, husky boys in the state and preserves among them perfect order.

There has been invented a machine which, in ten hours, will paste paper labels on one hundred thousand tin cans. The cans roll down a chute, and each in its journey picks up a label.

FOR THE SKILLFUL PLUMBER.

A neat little trick that has been accomplished a few times by skillful plumbers is the removal of a sink or shower faucet from a lead pipe without disturbing the woodwork back of the fixture, says the Metal Worker. To remove the cock without disturbing the woodwork, tacks or



anything, is quite a feat. To do it the plumber must heat the old cock so hot that it will release itself from the solder by a twist with the hand, when it can be drawn out quickly. The new cock must be already tinned and quite hot, ready instantly to take the place of the old one. The tinning of the new cock should extend at least ¼ inch further than usual. When cool wipe fresh solder around the ¼-inch space at A. In a great many cases the sink has to be taken down, a couple of feet of pipe used, with extra solder, tacks and screws, and possibly with some damage to the woodwork. All of this can be avoided, however, by a quick and skillful workman.

BOTTLE MESSAGE FOUND AFTER 28 YEARS.

A bottle recently picked up on the coast of Massachusetts contained a message saying that it had been thrown overboard from the ship Hattie E. Tapley, of Bangor, on April 13, 1874, in the Indian ocean. Capt. George H. Tapley, of West Brooksville, Me., who then commanded the ship, says that he was in the Indian ocean in that year and month, and believes that the inscription was written and the bottle set afloat by a German sailor.

CAN TELEPHONE UNTIL TRAIN STARTS.

A telephone system by which passengers may be able to keep in touch with their home folks or business offices up to the time of the train's departure is being instituted at cities along the routes of the Northwestern, Union Pacific and Southern Pacific railroads. The new service is to be in connection with the "overland limited" trains. The promoters say the service will aid in the transaction of important business that otherwise might have to be done while en route and will prove valuable to patrons who forget articles which they purposed taking with them. The telephone company has agreed to give a special wire connection between train and the main office, says the Fourth Estate, and guarantees almost instant connection. This will enable the use of the telephone to within about 30 seconds of the leaving time of the train.

WHEN WANAMAKER TURNED BRICKS.

When only 5 years old John Wanamaker worked as an assistant brick maker. His duty was to turn the bricks in the sun until they were evenly baked. For this labor he received 2 cents a day and sometimes cleared 10 cents a week. When he grew older he obtained a position as office boy, which marked the beginning of his rise to fortune. He worked as assistant in the office until he had climbed up to $6 a week. He had been saving all the time and soon he had enough to start in business for himself. Seeing that he could get no further raise in salary he bought a little stock of cheap furniture and started in to be a merchant.

TROUSERS REVERSED.

At a recent reception in Washington Doctor Mary Walker, attired in gentleman's full evening dress, was presented to Minister Wu. The champion of woman's rights critically surveyed the distinguished diplomat a moment. At last she let him have it, with a look that might have annihilated one less a philosopher:

"Why do you wear petticoats, Mr. Wu?"

The minister, smiling blandly, as only a Chinaman can, replied:

"Because it is the custom of my country, madam," and then, after a slight pause, to give his words all the effect possible, "Why do you wear trousers, madam?"—April Lippincott's Magazine.

Miss Leola Stidham, a Creek Indian girl of remarkable beauty, now a student of Hardin College, Mexico, Mo., acted as sponsor for the Indian Territory division of the United Confederate Veterans at the national reunion at Dallas, Tex., April 22.

TRAPPING CYLINDER DRIPS.

Allow us to suggest to your readers, —writes a correspondent to Power,—the use, upon the drips of an engine cylinder, of a steam trap which works upon the thermostatic principle, passing water but

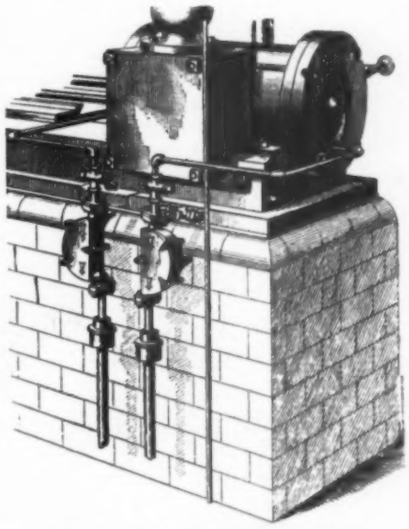


FIG. 1. TRAPPING CYLINDER DRIPS

closing when live steam or air of a temperature above 212 degrees attempts to pass. These traps can be arranged as in Fig. 1, discharging into open waste pipes so that the discharge can be easily seen, or a single trap can be used for both ends of the cylinder by putting in check valves, as shown in Fig. 2. These traps are in general use in Continental Europe for this purpose and are regarded as part and parcel of the equipment of an up-to-date engine.

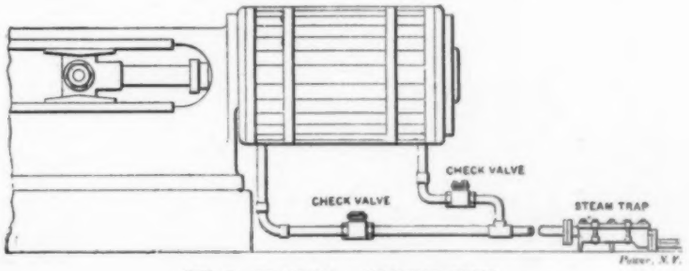


FIG. 2. TRAPPING CYLINDER DRIPS.

In addition to relieving the cylinder while under operation of any accumulation of oil and water, these traps remain open when the engine is not operating, draining the cylinder and precluding the possibility of its rusting; and they remain open after the engine is started until all water coming into the cylinder has been drained out of the drips, thereby making them an automatic safety apparatus. We believe this fact, together with the general simplicity of the idea, will commend it to intelligent engineers.

GIANT ELECTRICAL MACHINES.

Great Generators Which Produce 5,000 Horsepower Each.

These are days of great things in engine and machine construction. A few years ago we measured large stationary engines by their hundreds of horsepower; now the hundreds excite no interest and have grown into the thousands. It is comparatively only a little time ago, when all the generators for producing electricity for light, railway or power purposes were driven by a belt from an engine. Now only the smallest are so driven, and instead the generator is placed beside the engine, and one massive steel shaft is used for both engine and generator. This method is called direct connection. Then in all electrical machines the fields were stationary and the armature revolved.

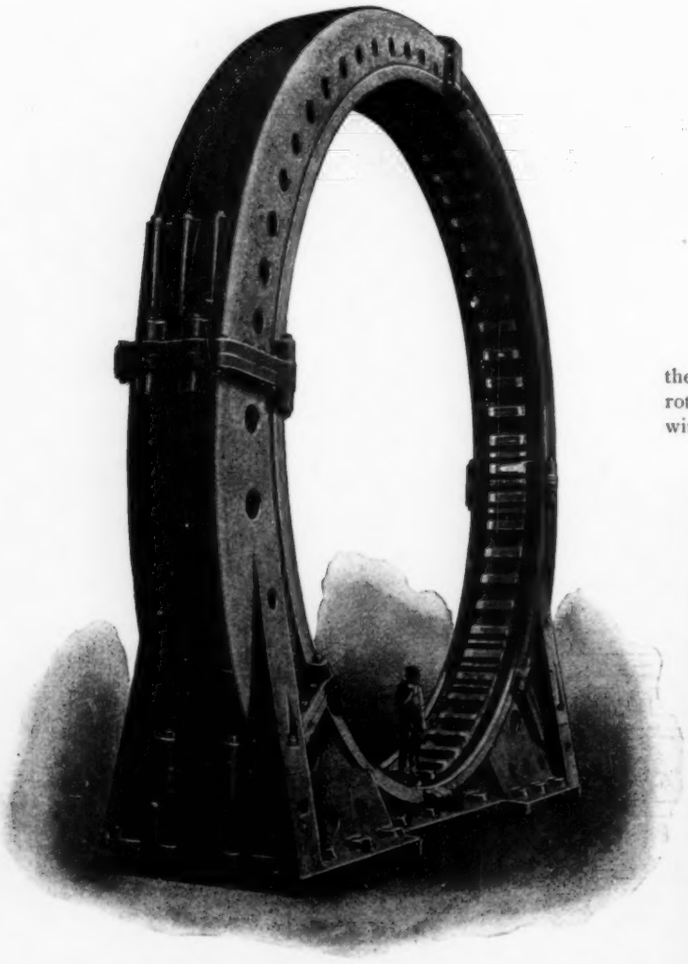


FIG. 1.—ARMATURE FRAME OF 5,000 K. W. ALTERNATOR.

Now there are types in which the fields are rapidly revolved and are made a part of the flywheel which as such has disappeared.

For the operation of the elevated railway cars of the Metropolitan road in New York some interesting machines have been built and installed by the Westinghouse Electric & Manufacturing Co. Fig. 1 shows the armature frame of a 5,000-kw. alternator, which is nearly 40 feet high. The frame for this immense structure is cast in six pieces and weighs hundreds of tons. In this type of alternator the armature is stationary and the field revolves; and the field current instead of the armature current passes through the brushes and collector rings. This class of machine is adapted to high voltage or large current output. Fig. 2 shows the rotating field under construction ready to receive

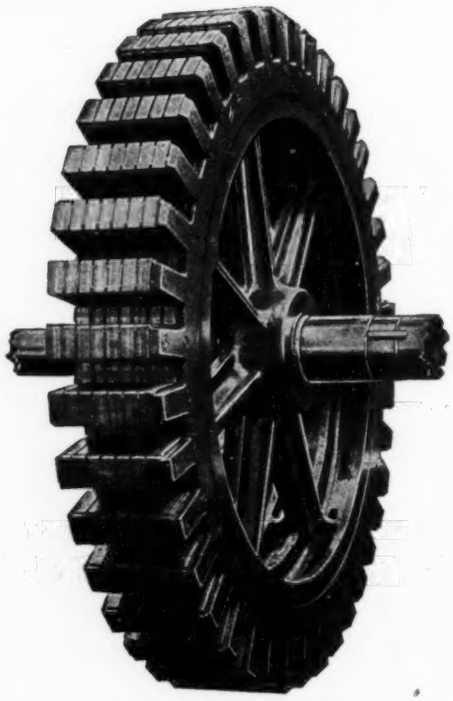


FIG. 2.—ROTATING FIELD READY TO RECEIVE COILS.

the coils, and Fig. 3 shows the coils in place on a portion of a rotating field. When completed the revolving field is placed within the armature frame shown under construction in Fig. 1.

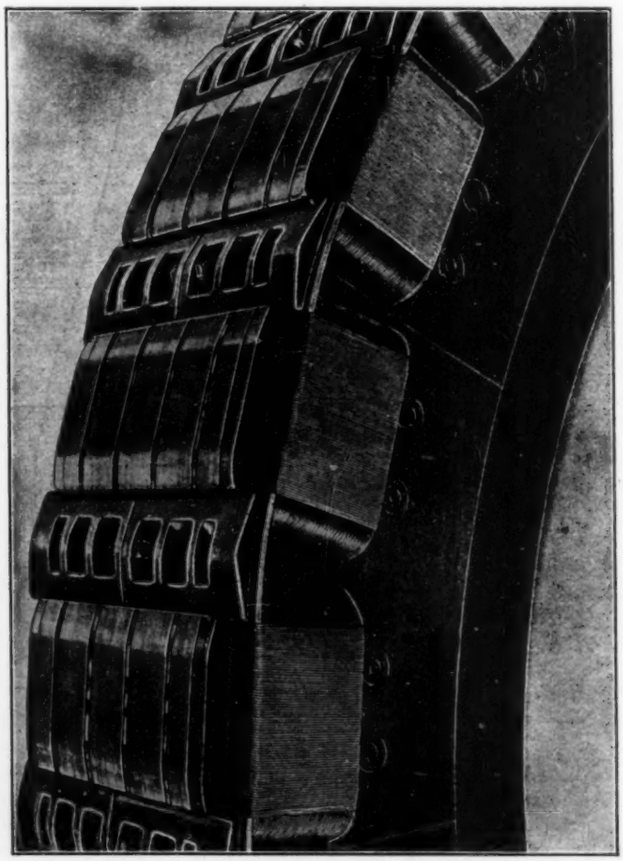


FIG. 3.—PORTION OF ROTATING FIELD SHOWING COILS IN PLACE.

FIRE THAT BURNED HALF A CENTURY.

Began in Carbon County, Pa., Before the Civil War and is Just Now Out.

A fire that started in Carbon County, Pa., before the civil war has just gone out. It burned for 53 years continuously, sometimes illuminating the heavens for miles about. When it first broke out more than a half century ago, there were heroic efforts to extinguish the maddened flames, but as days, weeks and months measured the time of the unequal battle, the firefighters surrendered to the flames. Many, then in their youth, who fought the fire, have died of old age, and still it burned on. Children whose earliest recollections was this seeming perpetual conflagration, have passed the meridian of life in constant view of the burning pile.

It was a mountain of coal that fed this most remarkable fire on record—a mine in Summit Hill, Pa. The mass of coal towered seventy feet above the cavity where the fire first started and the veins outcropped at the top. The Western Fireman says:

Of late years the fire had so eaten up into the hill that at night it could be seen for miles.

The final act of this fire was witnessed by just one man. He was on his way home from work when there came from the mountain the noise of explosions. He drew nearer. There was a gust of flames and ashes went up into space; the peak of the hill had fallen in and the great fire was out. The final work of destruction lasted but a half hour.

BIRDS THAT NEVER COME TO GROUND.

Olive Thorne Miller has discovered that there are whole families of birds that spend their lives in the air and never come to ground. These are as odd, she says, as the birds that live continually in the water. In some of the tropical forests where trees are between 200 and 300 feet in height, the upper branches and the air above them are the home of countless birds and insects and monkeys. More than 200 feet from the earth below they find not only light and air but food in plenty, and even water in the various reservoirs of the giant plants and creepers.

CAPTURE OF A YOUNG SEA COW.

A young manatee, or sea cow, was recently captured on the beach at New Smyrna, Fla. It was about four feet long and was evidently helpless. The specimen will be preserved for scientific purposes, as it is probably the first newly born manatee ever captured.

THE KIND OF WOMAN MAN ADMIRES.

Thre is a difference between the "woman's woman," says the Inter Ocean, "and the woman a man likes. The man's woman, like the poet and painter, is born, not made, and is essentially feminine—a most womanly woman. Sympathetic and affectionate by disposition, she is just suggestively clinging and dependent enough to arouse all a man's protective instinct, appearing submissive to his higher authority, lovable at all times, and the happy possessor of that intangible but necessary trait, ycleped charmed. Were she as beautiful as Juno, as wise as Athena herself, the lack of this peculiar fascinating quality which so enslaves the masculine heart would not render her attractive even to the most callow of youths. This ideal woman knows and likes man as he really is. She never gossips about nor belittles her sisters. She has a kind word for them at all times but rarely, if ever, do they like her, and really the fault is on neither side, as she understands them quite as little as they comprehend her, and never at any time does she appear at her best before them. Modest at all times, she is never prudish. Thre is nothing a man dislikes more than a prude. Always cheerful she is, and the man likes her honest friendship and perfect candor. Her wardrobe may be limited, her clothes inexpensive, but she knows how to wear them gracefully. This woman you have all seen and often you have wondered why the men admired her so."

CORPSE ENTITLED TO BAGGAGE.

A corpse can have a trunk checked on its account, if the relatives desire. The traffic manager's association have decided that as the corpse is riding on a first-class ticket it is proper to allow 150 pounds of baggage also. The question recently arose when five mourners with six trunks and one corpse all wanted to travel on six tickets. The corpse won.

HIS KNITTING VEXED PARLIAMENTARIANS.

Members of the British parliament rejoice that Mr. Catheart Wason, the member for Orkney and Shetland, has abandoned his long pursued habit of knitting in the smoking room of the House of Commons.

The London Mail says: "Mr. Wason used to explain to inquirers that his eyesight was very bad, and that, as he could not be always reading, he took up knitting as a pastime. The innovation, though quite an innocent one, annoyed a number of old Parliamentary hands, and of late Mr. Wason's knitting needles have not been in evidence at Westminster."

DISPLAY RACK FOR LIGHT GOODS.

A home made stand for displaying tin covers or light flat goods is illustrated in the Metal Worker. The stand is made as shown in Fig. 1, as follows: A 1-inch base board, 17 inches square, rests on the narrow sides of two 2 by 4 joists. From the corners of this base board are erected two corner posts, 1 inch square, which step in a top board of 1-inch stuff measuring 11 inches square. About half way from the bottom board to the top board is placed

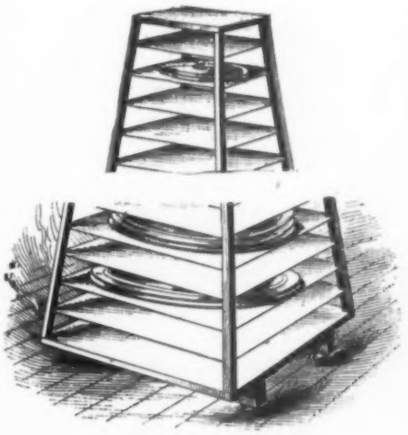


Fig. 1.—Stand for Covers.

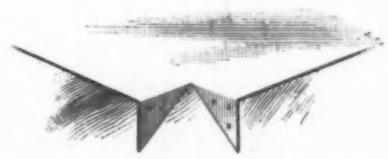


Fig. 2.—Construction of the Corners of Shelves.

a ½-inch wooden shelf to stiffen the construction. At intervals of about 3 inches between this and between the top and bottom boards are placed 16 shelves made of tin plate. The edges are turned and flattened down. Then a short cut is made in each corner on the diagonals and the corners are bent down as shown in Fig. 2. The sheets are then tacked to the uprights through the bent down surfaces, completing a useful and inexpensive piece of store furniture.

WINDOW GLASS THAT WILL NOT BREAK.

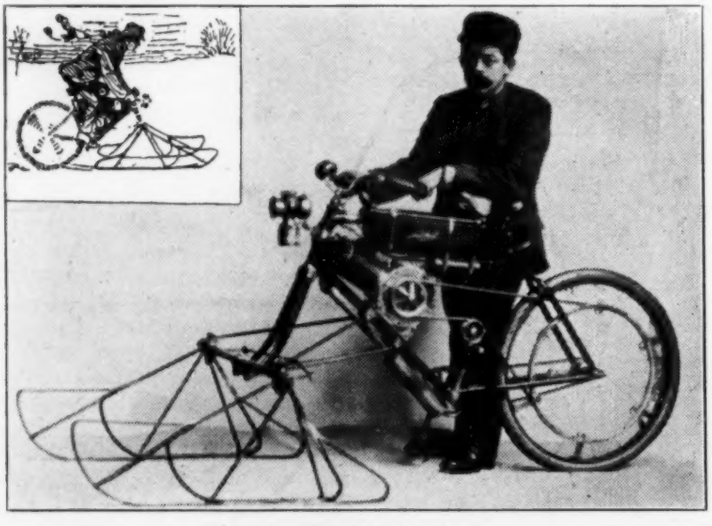
In the new building of a boiler works factory in Germany the ordinary panes of glass were impracticable on account of the nearness of the works to the railway lines. As a result pneumatic glass stones have been used. From the outside the appearance is the same as the so-called "Butzen" panes. They are translucent and at the same time as strong as the stone wall in which they are set. They will withstand any blow that the walls will stand.

EDUCATION TO PREVENT TRAIN WRECKS.

Education is considered the surest preventive of train wrecks by the Chicago, Burlington & Quincy. On that road the rules of the Master Mechanics' Association and the Superintendent's Association have been adopted, and every applicant for the position of fireman must tell in writing the schools he has attended and the opportunity he has had for education Graduates and all those having been afforded the better schooling facilities, it is understood, will be given the perference. Before the applicant is even given an opportunity to tell of the educational advantages he has enjoyed, however, he is compelled to undergo an examination on simple questions. Then if he passes this and is admitted as an applicant, he is given the second examination in writing, in which arithmetic, history, grammar and common sense come into play. The educational test is given by a committee composed of the road foreman and chief clerk of the master mechanic. The road officials claim that they make these requirements regarding firemen principally because it is from firemen that engineers are made.

NOVEL MOTOR SLED.

The motor sled is the latest novelty exhibited by the Whipple Cycle Company. It is the invention of Ira H. Whipple. The machine is one of the standard type of Mitchell motor bicycles with front wheel removed, says the Motor Age, and a pair of steel runners attached to either end of a 4-foot axle of generous proportions, placed crosswise of the fork. The runners are kept parallel by being mounted upon steering knuckles and connected by a system of linkage similar to that used upon most automobiles.



WHIPPLE'S MOTOR SLED.

MAY WEAR WOODEN NECKTIES.

A syndicate comprising English capitalists has been formed to promote the sale of "tie silks," composed of 50 per cent wood pulp and 50 per cent artificial silk. Samples are being submitted to the wholesale neckwear manufacturers, and considerable experimenting is taking place. In point of price this material shows advantage over conventional fabrics. Its lustre, feel and general appearance closely resembles genuine silk.

GOAT'S MILK FOR CONSUMPTION.

Believing that with a treatment of goat's milk he can accomplish the complete eradication of consumption, Dr. Robert Williams is establishing an immense goat camp in the Mogollon mountains of Arizona. Williams claims that he himself was cured of consumption by a diet of goat's milk, and he has experimented on hundreds of others with alleged similar results. The idea of the cure came to him by reading of the wonderful cures of goat lymph. He argued that if the lymph would cure locomotor ataxia, paralysis, chronic articular rheumatism and similar diseases, there must be virtue in goat milk for pulmonary affections. He has compiled statistics from experiments with his goat herd to demonstrate that the government could establish in Arizona a series of sanitariums where more than ten thousand patients could be accommodated and treated at no expense. The profits from the goats in wool, hides and meat, he claims, would be more than sufficient to pay for the care of the patients.

The biggest launch that has ever taken place was at Wallsend, England, recently, when a floating dock built for use in Burmuda was put into the water. The lifting capacity of the dock is 17,500 tons and its area is 69,000 square feet.

FOR THE MADAM

CHAIR ATTACHMENT.

Here is shown a recent idea for an attachment to any ordinary chair to provide

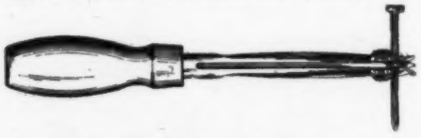
a substitute for the regulation baby high chair. The cut is self-explanatory.

HOW TO PREPARE POTATOES.

No. 5—Souffle potatoes—Peel the potatoes; cut the sides square, and trim off the corners, so as to give all oval shape. With one even cut slice them one-eighth of an inch thick the length of the potato; they must be all the same shape and size. Soak them in cold water for half an hour; dry them on a napkin, and fry them in fat which is only moderately hot until they are soft, but not colored. Remove and place them on a sieve to drain and cool. Then immerse them in hot fat, when they will puff into balls. Toss the basket and remove any that do not puff. Sprinkle with salt, and serve them on a napkin or as a garnish. Holland potatoes best suit this purpose; it is impossible to get the same result with most of the other varieties.

NAIL HOLDING IMPLEMENT.

With this instrument the most inexperienced woman can drive a nail without any



danger of pounding her thumb. A spring gripper holds the nail until started then releases by pulling the handle away.

Alarmed at the prevalence of the cigarette smoking habit among society women of New York and Chicago, the W. C. T. U. has inaugurated a crusade against the habit in social circles.

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APRIL 1902
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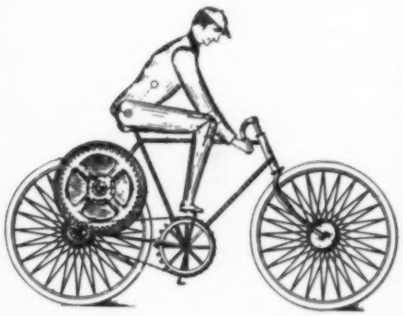
MECHANICAL TOY.

There seems to be a great demand these days for mechanical toys. Even quite young children prefer those toys which have action and are most life-like. Truly this mechanical age takes hold of the individual before he leaves the nursery. One of the most recent toys is that of a boy riding a bicycle, the invention of O. H. James, Mogollon, N. Mex. The toy is driven by a spring.



TROLLEY WINS ELECTROLYSIS SUIT.

The city of Dayton, O., has had a case in court several years, claiming damage from the electric railways of that place for a damage to water mains which had been damaged by the escaping electric current from the electric roads. The case has been watched with great interest by all electric railway people. The decision was in favor of the trolley roads. Inventions and improvements of the last few years have made it possible to prevent escape and leakage of the current to an extent which will cause damage.

It is said that the loan of $5,000,000 to be raised by Corea will be financed in the United States instead of Japan.

SCALE FOR VOLTMETER.

A request has been made that a scale for the voltmeter described in Chapter 9 of Easy Electrical Experiments for Boys, be published. The accompanying sketch shows such a scale, full size. It can be cut out and applied directly to the voltmeter. The instrument should be so adjusted that one cell of gravity battery will cause the pointer to move from 0 to 1 upon the scale. Then the remainder of the points upon the scale will be approximately correct.

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Attractions for Next Week.

Is it not remarkable the amount of inconsistency some people possess? An English minister says that heat hinders religion and that there is very little religion in the United States because everything (except the street cars) is overheated—an Englishman, whose king frequents the races, goes to concert halls on Sunday and brews beer. Wouldn't that—but we must not use slang in Popular Mechanics. An article about this Englishman's theory will be in the next issue.

Now it has been discovered that it is dangerous to wear whiskers; because whiskers, it is said, are receptacles for deadly disease germs. What will the germ theory lead to next? Read about it next week.

They have even got germ-proof armor, which is said to be more of a necessity than bullet-proof armor in these days of peace (except in the Transvaal, the Philippines, a few other nations and Kentucky). We will tell all about it next week.

But one of the best discoveries of recent days is: "A Sure Trick to Catch Bass." It is the secret of an old Minnesota guide who has been induced to part with it for the edification of Popular Mechanics readers. Of course you will want to read about that. A few of the other things we will tell about are: A one-man torpedo boat that can dart about under the water and blow up the greatest battleship afloat; the Sultan of Morocco has barred automobiles from his land because one of them ran away with him; two women who work at the forge as blacksmiths; where the world's supply of cork comes from; electrical experiments and mechanics for boys; many late useful mechanical inventions.

Remember, "When it is great Popular Mechanics will tell about it."

PHILIPPINE ISLANDS—Man who thoroughly understands running woodworking machinery, to go to Manila, P. I. Room 812, 135 Adams St., Chicago, Ill.

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BOYS are making $15 weekly soliciting subscriptions for Popular Mechanics, 604 Journal Building, Chicago, Ill.

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